Method for making an electronic label, and electronic label obtained by that method

Object of the present invention is a method of making an electronic label, as well as an electronic label obtained by realizing the method. Another object of the invention is a welding electrode allowing the method of making an electronic label according to the invention to be realized. The invention more particularly is concerned with the steps of a manufacturing process by which an electronic label can be produced that basically consists of a fibrous support such as paper and/or textile for instance, or of a plastic support, holding an electronic chip provided with two contact strips as well as an antenna consisting of a conducting wire.

Electronic labels are passive devices, or perhaps active devices, that can exchange data with an adequate reader also fitted with an antenna. With passive devices, data exchange between the reader and the electronic label occurs via electromagnetic coupling. When the label is close to the reader, the radiation field emitted by the reader's antenna allows the energy to be furnished that is required for the function of the electronic chip in the label.

Numerous applications are apt to use this technology, the management of a stock of articles provided with such labels, or the identification of objects bearing electronic labels being cited as nonlimiting examples. These electronic labels are marked out as an advantageous replacement of the bar codes or other ID markers on the most diverse objects, so as to optimise stock management that will then become automatic, or any other processing of the data supplied by these articles.

One of the particular difficulties encountered in the manufacture of such labels resides in fixing the antenna on the contact strips of the chip integrated into the label. This operation is in fact made difficult by the very small size of the chips used in such labels.

Known technologies for instance involve fixing the ends of the antenna with conductive glue on each of the two contact strips of the chip. Other technologies involve screen printing to integrate the antenna into a plastic sheet and then laminating this sheet onto the support of the label receiving the chip. These known technologies have certain disadvantages, of which for the use of conductive glues, one may cite the fact that the glue ought to be applied in a highly precise fashion to very small surface areas. For this reason one cannot avoid a flowing of the glue provoking short circuits making the label useless.

The laminating technologies in turn are difficult and costly in their realization.

It is the aim of the present invention to propose a method of making one or a number of electronic labels that is simple to realize, and allows electronic labels to be made more rapidly and more advantageously.

This aim is attained by a method of making that is distinguished by the characteristics cited in claims 1 and 3.

Another aim of the invention consists in offering a tool, and more particularly a welding electrode or welding head, that allows the method of making to be realized, and is distinguished by the characteristics cited in claim 7.

The aims, objects, and characteristics of the invention will become more apparent from a reading of the following description made while referring to the appended drawings in which:

Figure 1 illustrates an electronic chip used to realize a label according to the invention.

Figur 2 shows the operation of pulling a conducting wire, to be connected to the chip.

Figure 3 illustrates more particularly the welding electrode prior to the welding operation that allows the method of the invention to be realized.

Figure 4 illustrates the chip during the operation of welding of the conducting wire forming the antenna.

Figure 5 illustrates in a schematic way a version of the manufacture of an electronic label according to the invention where two segments of conducting wire are used to realize the antenna.

Reference is made to Figure 1 schematically illustrating a chip 1 provided with two contact strips 2, 3. The contact strips (2, 3) consist of a raised point of gold or tin, for instance, generally called a 'gold bumper' or 'solder bumper' according to sanctioned Anglo-Saxon terminology. The chips 1 used to realize the electronic labels according to the invention can be passive UHF chips, that is, chips lacking a power source that are powered by electromagnetic coupling thanks to a reader (not shown) that is provided with an antenna. The voltage induced in the label's antenna will be rectified and serves to power the chip. The chips available commercially typically will work at a distance of about four meters, and can be processed at the rate of about 400 articles per second.

An example of passive chips that can be used to realize the electronic labels according to the invention are those distributed under reference number EM4222 of the Swiss company EM Microelectronic-Marin SA.

The dimensions of such chips are of the order of 700 microns by 900 microns, while the gap between the contact strips 2 and 3 is of the order of 400 microns. The diameter of the contact strips is of the order of 80 microns.

It is understood that the method of making that is object of the invention may immediately be applied to realizing electronic labels using other chips, such as active chips or high-frequency chips, for example, when a conductor serving as an antenna must be connected with the chip's contact strips.

In the following description, the manufacturing steps are described in terms of a manual manufacture of an electronic label. It is obvious that all these steps may be automated in part or in full, by known means beyond the scope of the present application, and which for this reason will not be described in detail.

In Figure 1 a chip 1 adapted for realizing an electronic label laid out on a flat support piece is schematically represented. The bottom face of chip 1 that has no contact strips is in contact with the top face of the support piece.

An open dipole antenna must be connected to the contact strips 2, 3 of chip 1 in order to realize the electronic label. The antenna consists of a conducting wire 4, a copper wire for instance having a diameter between 50 and 100 microns.

In Figure 2, a conducting wire 4 is taken from a reel and brought in front of the two contact strips 2, 3 of chip 1. The wire 4 is cut at its two ends A and B once it has attained the length desired for antenna formation.

The next step of the method of making consists of welding the conducting wire 4 to the two contact strips 2, 3. This is realized with a welding electrode 5 having an active portion exhibiting an end provided with a recess 6 in its center. The width of recess 6 essentially corresponds to the distance between the two contact strips 2, 3, its depth to at least the height of the contact strips 2, 3. By way of example, such a welding electrode or welding head is schematically represented in Figure 3 in its position just prior to the welding operation.

In Figure 4 the welding head is pressed against the conducting wire. Under the effects of heat and pressure, the wire 4 is welded in a single operation to both contact strips

2, 3. The part of the conducting wire 4 between the two contact strips 2, 3 will deform under the effect of the heat. Moreover, the pressure exerted by the welding head 5 on wire 4 tends to accentuate this deformation, by adding to the material between the two contact strips 2, 3. Trials have shown that the conducting wire 4 undergoes a slight deformation forming a circular arc in the direction of recess 6 of the welding electrode.

The following step consists in cutting the conducting wire between the two connecting strips 2, 3 with the aid of an appropriate cutting tool, so as to eliminate the short circuit formed while welding the wire 4 onto the contact strips 2, 3.

To be noted that the welding operation, by virtue of the shape of electrode 5 comprising a recess 6, allows the wire 4 to be welded in a single operation to both contact strips 2, 3, which is an advantage with respect to operating speed. Actually, in other processes each end of the conducting wire is welded separately, which requires two distinct welding operations and attending loss of time. By virtue of the particular configuration of the welding head, and more particularly the recess 6 present in its center, one obtains a deformation of the conducting wire 4 after the welding operation that facilitates the cutting operation. Actually the segment of wire 4 between the contact strips 2, 3 exhibits the configuration of a circular arc facing outward, which diminishes the risk of damaging the chip during the operation of cutting the wire.

In a variant of the process illustrated in part in Figure 5, wire 4 is cut to the appropriate length in advance, and at least a portion of each of the two segments of wire 4 is brought in front of one of the two contact strips 2, 3. In this variant the welding operation is again unique, and allows the antenna to be formed in a single operation during which the two segments of the conducting wire 4 are welded to the strips 2, 3 with the aid of welding electrode 5.

The last step required to realize the electronic label consists of enveloping the assembly constituted by chip 1 provided with its antenna 4, between two layers of an appropriate material. To do this one may apply any known technology, cold or hot laminating of two sheets of a fibrous material (textile or paper) or of plastic, cold or hot gluing, or any other means to enclose chip 1 provided with its antenna 4 between two sheets of an *ad hoc* material.

In a variant, the electronic label merely consists of chip 1 provided with its antenna, to be directly integrated into diverse objects such as clothing for instance. In this case it is not necessary to enclose the chip with its antenna between two sheets of a fibrous material.

In another variant, the conducting wire 4 intended to form the antenna of the label is surrounded by a textile fiber sheathing. In this case a short length of wire must be stripped before being welded to the contact strips 2, 3 of chip 1.

The electronic labels obtained by this method are manufactured rapidly, partly by virtue of the unique welding operation. They also offer great reliability, inasmuch as the risk of short-circuiting of the two contact strips is reduced relative to other manufacting technologies.